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10/656,001	09/05/2003	Ravi Narasimhan	MP0256	7519

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EXAMINER

PHAN, HUY Q

ART UNIT PAPER NUMBER

2617

DATE MAILED: 05/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/656,001

Applicant(s)

NARASIMHAN, RAVI

Examiner

Huy Q. Phan

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 04/03/2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 2,4-11,13,15-22,24,26-33,35,37-44,46 and 48-59 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 2,4-11,13,15-22,24,26-33,35,37-44,46 and 48-59 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |  |
|--|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input checked="" type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)                        |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____   |

## **DETAILED ACTION**

### ***Response to Amendment***

1. This Office Action is in response to Amendment filed on date: 12/13/2005.  
Claims 2, 4-11, 13, 15-22, 24, 26-33, 35, 37-44, 46 and 48-59 are still pending.  
Claims 1, 3, 12, 14, 23, 25, 34, 36, 45 and 47 are cancelled.  
Claims 56-59 are newly added.

### ***Response to Arguments***

2. Applicant's arguments with respect to claims 2, 4-11, 13, 15-22, 24, 26-33, 35, 37-44, 46 and 48-59 have been considered but are moot in view of the new ground(s) of rejection.

### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 9, 11, 20, 22, 31, 33, 42, 44, 53 and 55 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

All expressions and variables in the equations must be defined.

### **Claim Objections**

4. Claims 35 and 56 are objected to because of the following informalities: Claims 35 and 56 are duplicated.

Claims 35 and 56-59 are objected to because the preambles of each of claims 35 and 56-59 is directed to "the method", where they are all depending on the independent claims 37, 40, 42 and 44, which are directed to "the system".

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2, 4-10, 13, 15-19, 21, 24, 26-30, 32, 35, 37-41, 43, 46, 48-52, 54 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Malaender (US-2003/0223391) in view of Kadous (US-6,801,580).

Regarding claims 4, Malaender teaches a method comprising:  
selecting a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0043]-[0051]; described as "channel coefficient matrix"). But, Malaender fails to expressly teach selecting a constellation for transmission on the active antennas where

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said selecting the constellation for transmission on the active antennas comprises selecting different constellations two or more of the active antennas. However, Kadous teaches a similar method of “patial receiver processing techniques include a channel correlation matrix inversion (CCMI) technique (which is also referred to as a zero-forcing technique) and a minimum mean square error (MMSE) technique” (see col. 20, lines 29-37); thus, making it analogous art since it is in the same field of endeavor. Kadous further teaches selecting a constellation for transmission on the active antennas (col. 17, lines 40-59; for more details see fig. 5, cols. 16-18) where said selecting the constellation for transmission on the active antennas comprises selecting different constellations two or more of the active antennas (col. 14, lines 6-10, for more details see fig. 4 and cols. 14-16). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to “process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing” (see SUMMARY).

Regarding claims 7, Malaender teaches a method comprising:

selecting a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0043]-[0051]; described as “channel coefficient matrix”). But, Malaender fails to expressly teach where said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin. Kadous further teaches

where said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin (col. 16, lines 15-33; for more details see cols. 11-16). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 15, Malaender teaches an apparatus (fig. 1B) comprising:  
a processor (fig. 1B, 140) operative to select a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0043]-[0051]; described as "channel coefficient matrix"). But, Malaender fails to expressly teach wherein the processor is operative to select a constellation for transmission on the active antennas and select different constellations two or more of the active antennas. Kadous further teaches wherein the processor (col. 21, lines 3-11) is operative to select a constellation for transmission on the active antennas (col. 17, lines 40-59; for more details see fig. 5, cols. 16-18) and select different constellations two or more of the active antennas. (col. 14, lines 6-10, for more details see fig. 4 and cols. 14-16). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved

performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 18, Malaender teaches an apparatus (fig. 1B) comprising:  
a processor (fig. 1B, 140) operative to select a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0043]-[0051]; described as "channel coefficient matrix"). But, Malaender fails to expressly teach where the processor is operative to select a constellation for transmission on the active antennas and select an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin. Kadous further teaches where the processor (col. 21, lines 3-11) is operative to select a constellation for transmission on the active antennas and select an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin (col. 16, lines 15-33; for more details see cols. 11-16). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 26, Malaender teaches an apparatus (fig. 1B) comprising:  
a processor (fig. 1B, 140) including means for selecting a subset of active antennas from a plurality of available antennas in an multi-element antenna system

based on higher-order statistics of a propagation medium. But, Malaender fails to expressly teach means for selecting a constellation for transmission on the active antennas including means for selecting different constellations two or more of the active antennas. Kadous further teaches means for selecting a constellation for transmission on the active antennas (col. 17, lines 40-59; for more details see fig. 5, cols. 16-18) including means for selecting different constellations two or more of the active antennas (col. 14, lines 6-10, for more details see fig. 4 and cols. 14-16). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 29, Malaender teaches an apparatus (fig. 1B) comprising:  
a processor (fig. 1B, 140) including means for selecting a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium. But, Malaender fails to expressly teach where said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin. Kadous further teaches where said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin (col. 16, lines 15-33; for more details see cols. 11-16). Therefore, it would have been obvious to one of ordinary skill in the art at the

time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 37, Malaender teaches a system (fig. 1) comprising:

- a propagation medium (fig. 1A, 130);
- a first transceiver including a plurality of available antennas (fig. 1A; antennas 111a-m);
- a second transceiver including a plurality of available antennas (fig. 1A; antennas 121a-n);
- a processor (fig. 1B, 140) operative to determine higher-order statistics of a propagation medium from signals received from the plurality of available antennas at the first transceiver ([0046]-[0047]); and antennas selection module operative to select a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0046]-[0047]).But, Malaender fails to expressly teach where the processor is operative to select a constellation for transmission on the active antennas and select different constellations two or more of the active antennas. Kadous further teaches where the processor (col. 21, lines 3-12) is operative to select a constellation for transmission on the active antennas (col. 17, lines 40-59; for more details see fig. 5, cols. 16-18) and select different constellations two or more of the active antennas (col. 14, lines 6-10, for

more details see fig. 4 and cols. 14-16). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 40, Malaender teaches a system (fig. 1) comprising:

- a propagation medium (fig. 1A, 130);
- a first transceiver including a plurality of available antennas (fig. 1A; antennas 111a-m);
- a second transceiver including a plurality of available antennas (fig. 1A; antennas 121a-n);
- a processor (fig. 1B, 140) operative to determine higher-order statistics of a propagation medium from signals received from the plurality of available antennas at the first transceiver ([0046]-[0047]); and
- antennas selection module operative to select a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0046]-[0047]). But, Malaender fails to expressly teach where the processor is operative to select an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin. Kadous further teaches where the processor (col. 21, lines 3-12) is operative to select an optimum number of

antennas to maximize a minimum signal-to-noise (SNR) margin (col. 16, lines 15-33; for more details see cols. 11-16). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 48, Malaender teaches a computer program [0054] comprising the steps of:

selecting a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0043]-[0051]; described as "channel coefficient matrix"). But, Malaender fails to expressly teach selecting a constellation for transmission on the active antennas where said selecting the constellation for transmission on the active antennas comprises selecting different constellations two or more of the active antennas. Kadous further teaches selecting a constellation for transmission on the active antennas where said selecting the constellation for transmission on the active antennas (col. 17, lines 40-59; for more details see fig. 5, cols. 16-18) comprises selecting different constellations two or more of the active antennas (col. 14, lines 6-10, for more details see fig. 4 and cols. 14-16). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath

channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 51, Malaender teaches a computer program [0054] comprising the steps of:

selecting a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0043]-[0051]; described as "channel coefficient matrix"). But, Malaender fails to expressly teach where said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin. Kadous further teaches where said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin (col. 16, lines 15-33; for more details see cols. 11-16). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claim 2, 13, 24, 35, 57 and 46, Malaender and Kadous disclose all the limitations of claims 4, 15, 26, 37, 40 and 48 respectively. Malaender further teaches wherein the higher-order statistics comprise second-order statistics of the propagation medium ([0046]-[0047]).

Regarding claim 5, 16, 27, 38 and 49, Malaender and Kadous disclose all the limitations of claims 4, 15, 26, 37 and 48 respectively. Kadous further teaches wherein the multi-element antenna system comprises a multiple-in multiple-out (MIMO) system (see abstract).

Regarding claim 6, 17, 28, 39 and 50, Malaender and Kadous disclose all the limitations of claims 4, 15, 26, 37 and 48 respectively. Malaender further teaches wherein said selecting comprises selecting the subset of active antennas based on correlation matrices among the active antennas ([0046]-[0047]).

Regarding claim 8, 19, 30, 41 and 52, Malaender and Kadous disclose all the limitations of claims 4, 15, 26, 37 and 48 respectively. Malaender further teaches wherein said selecting comprises selecting the subset of active antennas based on a fixed data rate [0018].

Regarding claim 10, 21, 32, 43 and 54, Malaender and Kadous disclose all the limitations of claims 4, 15, 26, 37 and 48 respectively. Kadous further teaches allocating substantially equal power to each of said active antennas (col. 15, lines 63-67).

***Allowable Subject Matter***

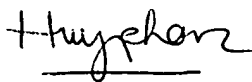
6. Claims 9, 11, 20, 22, 31, 33, 42, 44, 53, 55, 58 and 59 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action.

***Conclusion***

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Huy Q Phan whose telephone number is 571-272-7924. The examiner can normally be reached on 8AM-6PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, George Eng can be reached on 571-272-7495. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



GEORGE ENG  
SUPERVISORY PATENT EXAMINER